ORNL-6182

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OAK RIDGE NATIONAL LABORATORY

MARTIN MARIETTA

Environmental and Occupational Safety Division Annual Progress Report for 1984

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

4. ENVIRONMENTAL MANAGEMENT

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4.1 ENVIRONMENTAL ENGINEERING

The Environmental Engineering Group's major functions during 1984 included engineering support, project planning and coordination, and liaison with the ORNL facilities at Y-12. The main responsibility of the engineering support function is to coordinate input to all ORNL divisions and to Central Engineering regarding the potential environmental impact of proposed projects (i.e., providing criteria and technical review, generating and submitting permit applications). The Y-12 liaison function involves coordinating all Department activities for the ORNL facilities located at the Y-12 Plant. The group also provides major input to Department planning and engineering expertise to other groups within the Department.

Planning

The area of planning was an active one for the group during 1984. The long-range environmental plan (*Five Year Project Plan,* ORNL/TM-9200) was issued early in the year and again in June 1984. Each issue contained substantial revisions based on input from ORNL, the Department of Energy (DOE-ORO and DOE-HQ), and regulatory agencies (EPA and the State of Tennessee). The *Five Year Plan* documented the scope of and justification for each project and described how each fit into ORNL's overall environmental planning. In addition to the *Five Year Plan,* a *Supplemental Information Document* was developed (ORNL/TM-9200/S1). This document provided the legal requirements for each project and a discussion of possible legal implications. The combination of these two documents formed the basis for discussions on capital projects with regulatory and funding personnel.

Also, the group participated in development of Field Task Proposal/Agreements for expense funds in FY 1985 and FY 1986. These proposal/agreements covered seven different categories of noncapital tasks that were either corrective action environmental projects or activities required to support capital projects.

Project Coordination

1984 proved to be an extremely busy year for both funded and planned projects. Using expense funding, a number of problems were investigated.

- A number of PCB dikes around transformers at the ORNL facilities at Y-12 were improved. Modifications were aimed at the upgrade of existing dikes.
- Construction was completed on a new waste chemical room for the Biology Complex. Safety concerns with the old storage room were thus resolved.
- Sanitary sewer lines from a number of specific ORNL buildings in Bethel Valley were surveyed to determine any cross-connects of nonsanitary drainage.
- Drainage lines at ORNL facilities at Y-12 were surveyed. The survey included the documentation of the routing of all process drains from the Fusion Energy and Engineering Technology Division buildings to East Fork Poplar Creek. Thereafter, several drainage pipes were lined using the Insituform process. Lining of pipes was directed at elimination of mercury discharges to East Fork Poplar Creek.
- Laboratory surveys and chemical inventories were conducted to determine possible sources of certain chemicals in the process wastewater system.
- A PCB storage shed was designed for the area adjacent to Building 2018.

In addition to the expense projects outlined above, expense funding was used to fund Central Engineering to conduct studies and make estimates of FY 1985 General Plant Projects proposed by the Department. Seven projects were studied; estimated cost of the seven proposed projects is approximately $2.6 million.

Also, the group participated in the detail design of funded capital projects. Projects for FY 1984 included nine General Plant Projects, for which the total estimated cost was $2.3 million. Two of the funded FY 1984 projects have been completed, one of them ten months ahead of schedule. All funded projects are currently on or ahead of schedule.

Regulatory Interface

During 1984 the group provided substantial input to the following four areas of regulatory action: Resource Conservation and Recovery Act (RCRA); Clean Water Act; Solid Waste Disposal Act; and Safe Drinking Water Act—Underground Injection Control Program.

Resource Conservation and Recovery Act. The group provided the technical information that formed the basis for the RCRA Part A permit application for ORNL and participated in various interactions with EPA/TDHE personnel.

Clean Water Act. The group coordinated much of the Department's input to the Y-12 Plant regarding wastewater discharges from ORNL facilities at Y-12 and the related effect on the new Y-12 National Pollutant Discharge Elimination System (NPDES) permit. This effort included establishing plans to treat or to eliminate all wastewater that ORNL generates and coordinating proposed projects and their associated schedules and design information.

Also, the group participated in negotiations with the TDHE and EPA regarding the NPDES permit for the ORNL facilities. This included establishing formal plans for treatment or elimination of discharges from ORNL.

Solid Waste Disposal Act. During 1984 the group supervised a subcontract for the development of a permit application for the existing ORNL Contractors' Landfill. Development of this permit application included the information necessary to establish a closure plan for the facility.

Safe Drinking Water Act. Finally, the group reviewed proposed state regulations on underground injection and participated in discussions with the regulators. The group assisted in determining the effects these regulations may have on the operation of the hydrofracture facility at ORNL.

4.2 DATA AND INSTRUMENTATION

4.2.1 Functions

The Data and Instrumentation Group is responsible for assembling, processing, assessing, and reporting the major portion of the environmental monitoring data within ORNL plant boundaries as well as data collected on the DOE Oak Ridge Reservation (ORR). Environmental monitoring programs for ORNL include sampling and analysis of air, water from surface streams, groundwater, biota, and soil for both radioactive and nonradioactive materials. For CY 1984, over 35,000 analyses were processed on over 13,000 samples. The group is also responsible for the preparation of data for the execution of computer models that calculate the potential radiation dose to the public from discharges from the three Oak Ridge facilities, Paducah Gaseous Diffusion Plant (PGDP), Goodyear Atomic, and National Lead of Ohio.

The group is responsible for preparation of sampling media and submission of samples for analysis. Another responsibility is the analysis of thermoluminescent dosimeters (TLDs) to determine external background radiation levels in and around the ORR. TLD samples are also analyzed for PGDP.

Members of the group, along with those in the Surveillance Group, are responsible for the development and review of an operating manual that describes sampling and analysis methods and procedures for each monitoring activity. The group has also worked on a three-plant task force to develop standardized sampling procedures for certain monitoring programs such as groundwater, soil and sediment, and surface water.

The group is responsible for developing QA procedures for all aspects of the monitoring program including field sampling, laboratory analyses, instrument calibration, data entry and verification, and reporting.

The QA of data entry and verification involves the use of a commercial software package for direct key-to-disk entry, full-screen editing, and rekeyboarding. Data entry errors have also been minimized by the development of a computer-based system to transfer data electronically from Analytical Chemistry Division's Sample Transaction System into three System 1022 data bases for analysis. This computer-based system also provides QA by checking numerous fields such as sample identification, date, analysis, units, and reporting limits for errors and generating a daily report. This system has been documented using the ANSI standard for digital computer programs.

During the report period, the group was responsible for assuring proper operation and calibration of all environmental monitoring systems. Also, during this period the group was responsible for preparing action description memoranda for all construction and renovation projects that could potentially have an environmental impact.

4.2.2 Activities During 1984

Environmental Monitoring Data

This report presents results of routine environmental monitoring conducted by the Department of Environmental Management. For a detailed description of the Department's environmental monitoring programs and results, the reader should refer to the annual *Environmental Monitoring Report for the Department of Energy Oak Ridge Facilities.*[1] Results presented in this document are generally limited to data that are not contained in the previously mentioned report. Special projects and nonroutine monitoring done during 1984 will be described in subsequent sections.

Atmospheric Monitoring

The results for data collected at the perimeter air monitoring (PAM) and remote air monitoring (RAM) stations are reported elsewhere.[1] For the local air monitoring (LAM) stations, the average concentration of alpha radioactivity in the atmosphere as measured with particulate filters was 0.96E−4 Bq/m^3 (0.26E−14 μCi/cm^3) during 1984, essentially equivalent to that for the previous year. Beta particulate results were 0.10E−2 Bq/m^3 (0.27E−13 μCi/cm^3), which is on the order of one-half of the concentration measured in 1983.

The average activity on gummed paper for the three air monitoring networks for 1984 was 3.4 Bq/m^2 (8.4E−6 μCi/ft^2) as compared to 2.5 Bq/m^2 (6.2E−6 μCi/ft^2) for 1983.

The average concentration of beta radioactivity in rainwater collected from the LAM stations was 3.9E−4 Bq/cm^3 (1.1E−8 μCi/cm^3), which was on the order of 70% greater than that reported for LAM stations for 1983. The remote monitors showed similar trends and levels. This indicates that the increase was probably not a result of ORNL operations. Other air-related data did not show increases, so the increase of activity in rain water could be the result of different rainfall patterns or increased dust in the air at the time of initial rainfall.

The radionuclide releases from ORNL stacks are summarized in Table 4.1. In addition to the nuclides reported in Table 4.1, 11 TBq (310 Ci) of ^{220}Rn was released from Stack 7911. The ^{220}Rn resulted from the storage of a neutron-irradiated ^{226}Ra source.

Water Monitoring

White Oak Lake Waters. As shown in Fig. 4.1, the 1984 discharges of ^{3}H and ^{90}Sr to the Clinch River were up from 1983. Table 4.2 shows all of the measured radioisotopes

[1]Martin Marietta Energy Systems, Inc., *Environmental Monitoring Report, United States Department of Energy Oak Ridge Facilities.* For 1983 results see Y/UB-10, issued 1984. The report number for 1984 data is not yet available.

Table 4.1. Annual discharges of radionuclides to the atmosphere

Stack	^{3}H		^{85}Kr		^{131}I		^{133}Xe		Unidentified alpha	
	TBq	kCi	TBq	kCi	GBq	Ci	TBq	kCi	kBq	μCi
2026					1.6E−2	4.4E−4				
3020					3.0E−4	8.0E−6				
3039	1.2E+3	3.3E+1	340	9.1	1.7	4.5E−2	1.6E+3	4.4E+1		
7025	15	0.4								
7911			210	5.8	2.1	5.7E−2	1.0E+3	2.8E+1		
Transuranic Laboratory									3.4	0.093
4508									0.1	0.003
Total	1.2E+3	3.3E+1	5.5E+2	1.5E+1	3.8	1.0E−1	2.6E+3	7.2E+1	3.5	0.096

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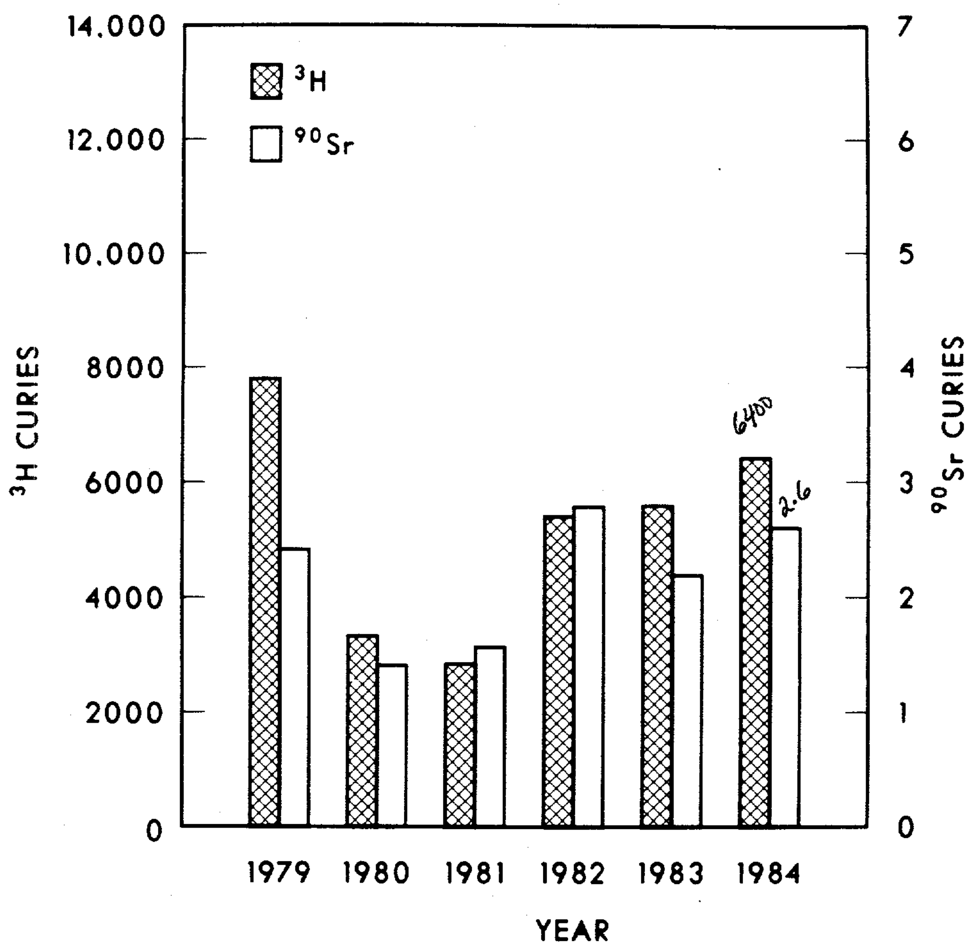

Fig. 4.1. ^{3}H and ^{90}Sr curies discharged over White Oak Dam.

Table 4.2. Discharge of radionuclides to the Clinch River in 1984

^{90}Sr		^{106}Ru		^{137}Cs		Alpha		^{3}H		^{131}I	
GBq	Ci	GBq	Ci	GBq	Ci	GBq	Ci	TBQ	Ci	GBq	Ci
96	2.6	8.1	0.22	21	0.56	1.0	2.8E−2	2.4E+2	6.4E+3	1.8	4.8E−2

discharged during 1984. Water samples for analysis of nonradioactive substances are collected at the same locations as those for radioactive water sampling. All are composited for monthly analyses and analyzed for a variety of water quality parameters related to process release potential and background information needs by analytical procedures recommended by the EPA. Figure 4.2 shows the percentage of compliance for the three parameters at the sewage treatment plant that caused the majority of the NPDES noncompliances at ORNL during

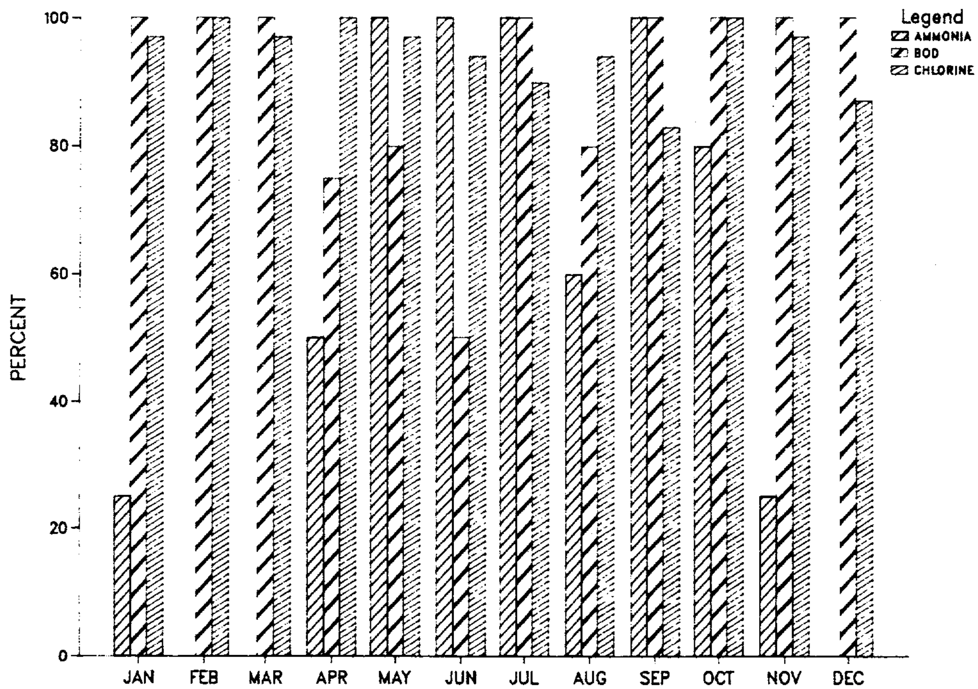

Fig. 4.2. Percentage of compliance for the three parameters at the sewage treatment plant that caused most of the NPDES violations at ORNL during 1984.

1984. The installation of a new extended aeration package plant, which should correct most of the problems, was completed during August 1985.

Potable Water. ORNL potable water is processed water from Melton Hill Dam that is analyzed quarterly; the results serve as a background comparison for water supplies downstream from ORNL on the Clinch River. In addition to the processed water sample, a nonprocessed sample from the Melton Hill Dam sampling station is collected and analyzed quarterly for water quality parameters of interest. Concentration results and dose commitment calculations are reported elsewhere.[1]

Radiation Background Measurements

The data on average external gamma radiation background measurements showed 2.2E−9 C/kg/h (8.7 μR/h) at remote stations, 2.2E−9 C/kg/h (8.7 μR/h) at the DOE perimeter stations, 2.4E−9 C/kg/h (9.4 μR/h) at the ORNL perimeter stations, and 8.0E−9 C/kg/h (31 μR/h) at local stations. These measurements are all essentially the same as those of the previous year.

Dose Commitments Due to Air Emissions from ORNL. The dose commitment to an individual continuously occupying the residence nearest the site boundary would result from inhalation and ingestion of gaseous discharges from ORNL; an inhalation rate of 2E+4 L/d for the average adult is used. Calculated dose commitments at this location were 4.3 μSv (0.43 mrem) to the pulmonary tissues (the critical organ) and 2.9 μSv (0.29 mrem) effective dose equivalent; ^3H is the important contributing radionuclide. These levels are 0.6% and 1%, respectively, of the EPA National Emission Standards for Hazardous Pollutants.

Upgrade of Stream Monitoring Stations

A project to upgrade the stream monitoring stations at Melton Branch (MB), White Oak Creek (WOC), and White Oak Dam (WOD) is essentially complete. The stations consist of new weirs, equipment shelters, and monitoring and sampling equipment.

At each of the stations, new equipment was installed to provide water sampling proportional to stream flow. The flow at the weirs is measured with an ultrasonic flow meter that contains a microprocessor to translate weir water level to a flow proportional control for the water sampler.

To establish radiation levels of the water effluent, new gross beta and gamma radiation monitoring equipment was installed. In addition, a robot monitor is used to monitor the following parameters continuously: pH, dissolved oxygen, turbidity, conductivity, and temperature. The robot monitor is a modular, automatic water quality data acquisition system capable of meeting NPDES requirements.

A microprocessor is provided at each station to monitor the data and alarm signals. The data and alarm signals from WOD and WOC are telemetered to a data concentrator located at the Melton Branch station. The data concentrator telemeters these signals to the waste operations control center. In the future, the signals will also be transmitted to the DEM environmental information system (EIS).

Planning

The group is responsible for the design and implementation of an EIS that will combine and integrate DEM's numerous data resources into a centralized system from which statistical analyses, graphics, and reports can be easily generated. Components of the EIS are shown in Fig. 4.3. The hardware in the box identified in the figure as "host system" was purchased and installed this past year. Software, including FORTRAN, EASYENTRY, and SAS, has been installed and debugged. Software applications have been developed on the host computer (VAX 11/750) and documented for data entry, analysis, and reporting for milk samples, surface water monitoring, and NPDES compliance monitoring. Software is being developed for processing current meteorological data from ORNL and ORGDP. Hardwire lines have been installed to the other Oak Ridge facilities; however, some of the devices used for communicating among the plants have not yet been installed.

The real-time data input systems and the two data concentrators shown in the figure are part of a Line Item Project that is scheduled for completion in 1987. Several real-time monitoring systems have been installed in the field and are currently connected to a PDP 11/40. Software is being completed for the communications with this computer. Software is also being developed for sending data from the PDP 11/40 to the host system.

Software for calculating dose to the public has been tested on the host system and should be fully implemented by 1986.

A local area PC network (designated as "DEM network" on the figure) is currently being installed. This will allow PC users to share peripheral devices and disk space. It will also interface with the EIS.

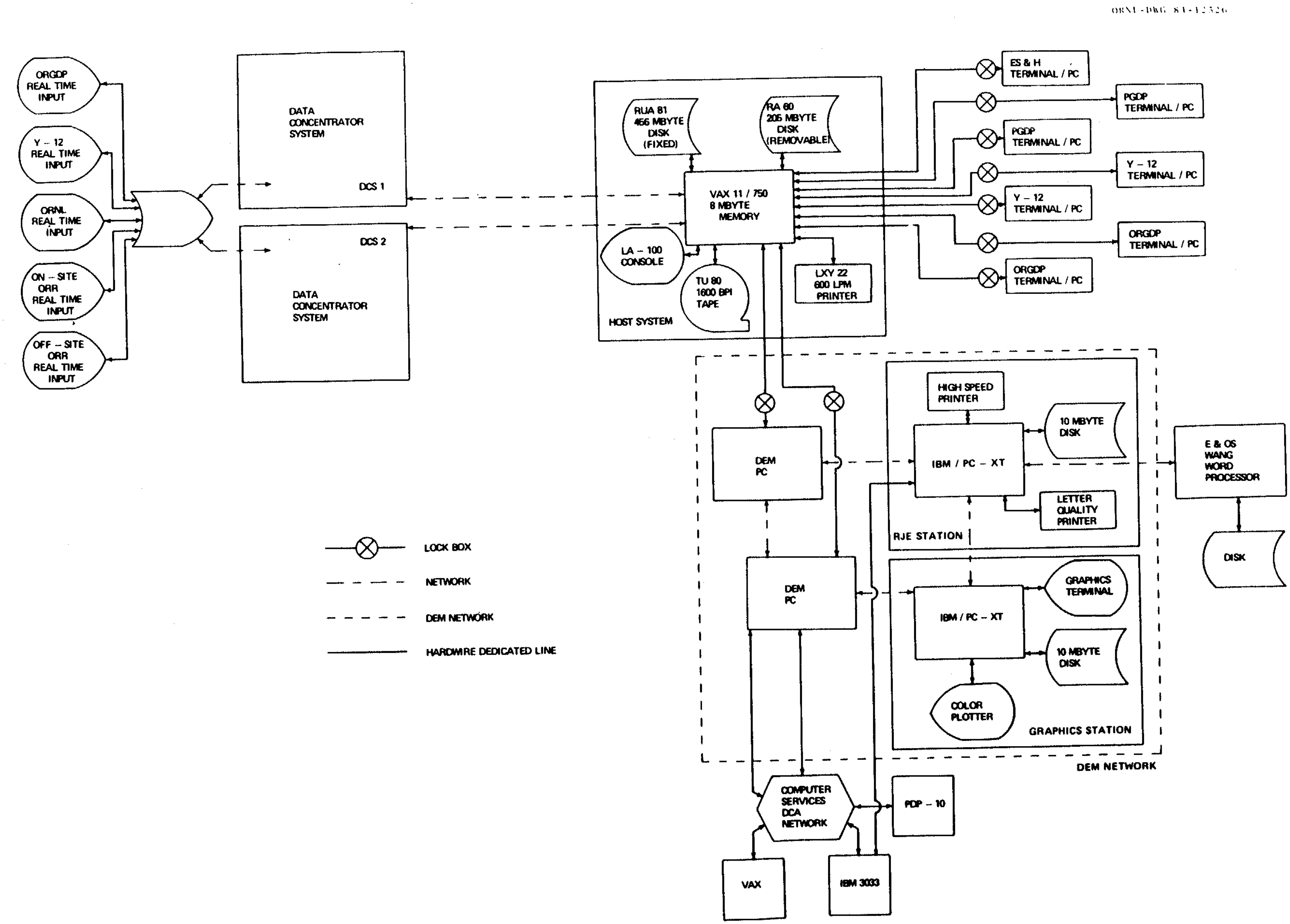

Fig. 4.3. DEM Environmental Information System.

An ADP protection plan has been prepared for the EIS, and the facilities and procedures have been reviewed by a special team of Martin Marietta employees from the three Oak Ridge plants.

The group, in coordination with the Geographics Group in the Computing and Telecommunications Division, is developing a PC-based system for displaying areal data such as sampling stations on various base maps. The system is a high-resolution graphics work station (labeled "graphics station" in the figure) that enables the DEM to interactively view areal data and overlay quantitative data (such as concentrations or discharges) on background images. It is a user-friendly system that also provides for color output of the displays.

4.3 ENVIRONMENTAL SURVEILLANCE

4.3.1 Functions

Compliance monitoring and support sampling for various environmental programs at ORNL are the major functions of the Environmental Surveillance Group in the Department of Environmental Management. Compliance monitoring is directed at meeting EPA and the State of Tennessee regulations, as well as DOE orders and requirements concerning effluent discharges from the Oak Ridge facilities. Three NPDES points are monitored daily, weekly, and monthly, respectively, for various nonradiological parameters to ensure that ORNL's discharges do not exceed acceptable environmental standards. In response to DOE orders governing the effluents released at DOE facilities, the group collects hundreds of samples from area surface streams, groundwater, soil, vegetation, insects, fish, rainwater, air, and various other environmental media. Other information is collected from field instrumentation, both real-time monitors and continuous monitors, with resulting data on pH, flows, radiation levels, radionuclide concentrations, chlorine, temperature, dissolved oxygen, conductivity, and turbidity.

4.3.2 Activities During 1984

During 1984, a number of special sampling programs were undertaken by the Surveillance Group in support of various environmental projects. The most extensive of these was the nonradiological characterization of eight streams that will make up the composite feed stream into the proposed nonradiological process wastewater treatment facility. Grab and flow-proportional samples were collected from the 3539 and 3540 ponds, Building 3544, the TRU and TURF facilities, the 2000 area, the 1505 area, and Building 3518. Data analyses included a number of field measurements (i.e., pH, dissolved oxygen, and temperature), as well as concentrations of major cations-anions, organic compounds, heavy metals, and other parameters. This effort was undertaken over a six-month period and resulted in information which was factored into the criteria design for the proposed facility.

Other special sampling or monitoring efforts during 1984 are listed below.

- Sampling of the effluent stacks at the Y-12 plant.
- Survey of the sewage sludge land-farm site to assess the levels of radioactive materials present in sludge taken from the City of Oak Ridge sewage treatment facility.
- Completion of sampling associated with the Surplus Facilities Management Program. This

effort allowed the assessment of decontaminating and decommissioning these facilities to be undertaken in a timely manner.

- Collection of white-tailed deer from the ORR roadways. During the year, 255 deer were killed by vehicles, an increase over the 201 in 1983.
- Preparation of "Environmental Sample Procedures, Collection and Preparation for Use Following a Nuclear Weapons Accident," for the DOE Radiological Assistance Program.
- Collection and analysis of data concerning the food chain transfer of radionuclides in insects and honeybees.
- Survey of Jones Island to identify areas of potential contamination resulting from sediment deposition on the island when that portion of the Clinch River was dredged to increase the channel depth.

The Surveillance Group also provided sampling support for a number of organizations other than ORNL.

- Soil and vegetation samples for the Y-12 plant.
- TLDs, wildlife, and vegetation samples for PGDP.
- TLDs for ORGDP.
- Process water samples for iodine determination for ORGDP.
- Information from the air monitoring stations and fish and wildlife samples for the ORR.
- Samples of uranium mine tailings ponds in Wyoming with the ORNL Energy Division for the NRC.

Staff members of the Surveillance Group also provided the following monitoring, sampling, and cleanup support in emergency response drills:

- Participated as members of the DOE Radiological Assistance Program (RAP) Team for the Watts Bar Nuclear Power station emergency exercise.
- Participated in a Department of Environmental Management drill to test emergency call procedures and response times.
- Responded to a drill conducted by the Laboratory Shift Supervisor's office involving the spill of acetic acid.
- Responded to a drill conducted by the Laboratory Shift Supervisor's office involving the spill of 50 gallons of toluene in a laboratory and sink drain in Building 3017.
- Provided an observer for a chemical spill drill conducted by the Y-12 plant.

4.4 HAZARDOUS MATERIALS CONTROL

4.4.1 Functions

The Hazardous Materials Control (HMC) Group is primarily responsible for managing hazardous materials and waste activities for ORNL and its facilities at the Y-12 site. Hazardous materials are controlled from their initial purchase or generation, during their use and storage, and during their treatment or disposal. This responsibility must be met for the Laboratory to comply with pertinent federal and state laws and regulations, DOE orders, corporate standard practice procedures, and Laboratory practices.

4.4.2 Activities During 1984

During 1984, 584 waste disposal requests containing 5769 items were handled by the HMC Group (Fig. 4.4). Figure 4.5 represents a percentage breakdown of the types of hazardous waste materials. Of the total generated, over 55% must be stored or disposed of via landfilling, incineration, or other controlled methods. These requests represented over 172,800 kg of material, 97% of which was hazardous waste materials generated by the ORNL facilities. As shown in the figures, the number of requests and the amount of waste handled by this group have steadily increased. A large majority of these materials are shipped to off-site commercial facilities for treatment or disposal. However, some waste streams are being managed by on-site operations (i.e., recovery of silver from photo reproduction wastes, recycle of noncontaminated oils, neutralization of acids, disposal of unstable reactive chemicals, recycle of waste mercury, detonation of explosive chemical wastes, and chemical reaction of water-reactive chemical wastes).

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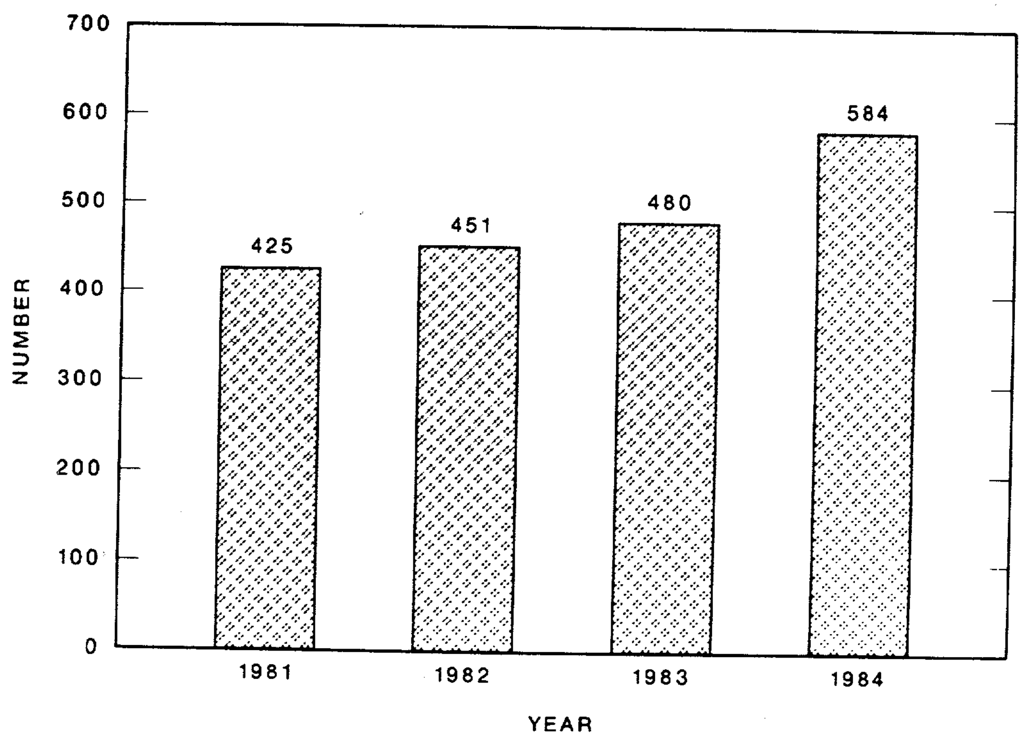

Fig. 4.4. Disposal requests processed by the Hazardous Materials Control Group.

Recycle/Recovery Operations

The silver recovery system, which began operation in 1982, processed over 41,630 L of silver-containing wastes during 1984. Approximately 4.4 kg of silver metal was recovered and returned to DOE's precious metal pool. In addition, approximately 220 kg of silver is present in the slurry, which has not been completely processed.

Approximately 32,170 L of noncontaminated waste oils generated by various Laboratory processes was recycled.

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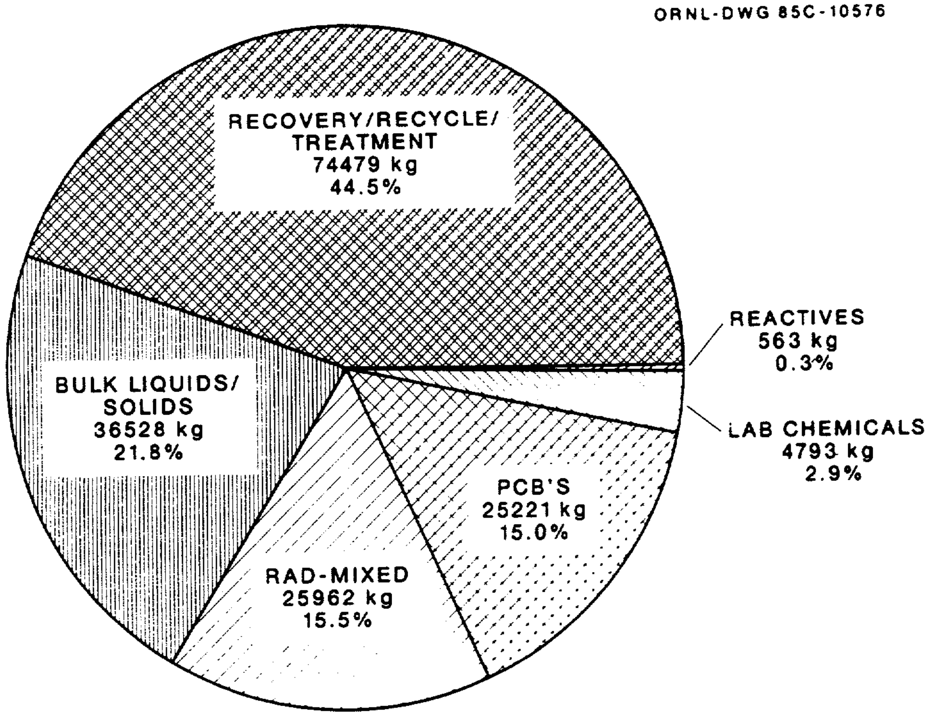

Fig. 4.5. Percentage breakdown of types of hazardous wastes.

Hazardous Waste Management Data Systems

Several computerized data systems were used by the HMC Group during 1984 in a continuing effort to provide accurate information on waste management activities. At present, the waste disposal files are in use. It is hoped that this system will be in full operation for all procurements in 1986.

The PCB tracking system maintains files on all equipment containing PCBs in use at the Laboratory, including dates the equipment is drained and removed from service, PCB concentrations, dates PCB wastes are placed in storage, and dates PCB wastes are shipped for disposal. This information is important for ensuring Laboratory compliance with the Toxic Substances Control Act and the regulations governing PCBs (40 CFR 761).

The asbestos waste disposal system has continued to be used effectively. In 1984, ORNL disposed of over 2970 m^2 of asbestos insulation from pipelines and over 25 m^2 of asbestos insulation from tanks and ductwork. During 1984, the Department continued to identify additional areas, both indoors and out, where asbestos insulation could pose potential hazards to personnel and/or the environment.

Permitting Activities

Calendar year 1984 brought tremendous expansion in permitting activities. ORNL's facilities under the jurisdiction of RCRA were identified, and efforts were launched or continued to obtain required permits. Required design drawings, maps, and operational information for the ORNL Contractors' Landfill were submitted and revised as requested by the State of Tennessee Division of Solid Waste Management in an effort to secure a permit for that facility.

During 1984, a considerable amount of personnel time was spent in the preparation and revision of RCRA Part A and Part B permit applications. These efforts were directed toward the goal of acquiring a hazardous waste permit and a mixed hazardous/radioactive waste permit for ORNL. This site-specific permit is an option distinct from that of acquiring separate permits for each of ORNL's RCRA waste facilities. The selected option is preferred in the interest of consistency and simplicity. Although the approach allows grouping of ORNL's RCRA waste treatment, storage, and disposal facilities onto two Part A applications, one for mixed and one for hazardous waste facilities, separate Part B applications are required. Preparation of these applications requires collecting and compiling a considerable volume of data and extensive reviewing of engineering drawings and specifications, existing procedures, and other information pertaining to the design and operation of each facility.

Mixed Waste and Hazardous Waste Part A applications were submitted and revised in response to regulators' requests. The Part B application for the proposed Chemical Waste Storage Facility was submitted and revised to accommodate the comments of DOE, EPA, and the TDHE staffs. The Part B application for the proposed Hazardous Waste Storage Facility, originally submitted in August 1982, was revised several times to suit regulators.

As part of the regulatory review and negotiation process, several conferences were held involving EPA, TDHE, DOE, and Martin Marietta Energy Systems, Inc., staffs. At the last of these, on November 28, the site-specific permit approach was developed and approved, and a schedule was established for the submission of required Part B applications.

Disposal of Reactive/Explosive Chemical Wastes

The HMC personnel were able to dispose of explosive chemical wastes. Through the use of commercially available plastic explosives, 47 kg of these waste materials was detonated in accordance with requirements outlined in 40 CFR 265.382.

Various other activities of the group included:

- Updating and revising ORNL's Spill Prevention Control and Countermeasures and Contingency Plans.
- Preparing ORNL/TM-9060, entitled *Resource Conservation and Recovery Training Program*, by B. D. Barkenbus and B.M.Eisenhower.
- Documenting a new procedure, "The Manifest For Transportation of Hazardous Waste," and updating procedures, "Environmental Protection Officers," "Prudent Practices for Storage of Nonradioactive Hazardous Chemicals in Laboratories," and "Disposal Procedures For Hazardous Waste Materials," for the *ORNL Environmental Protection Manual.*
- Treating Y-12 photographic waste solutions by the ORNL silver recovery process.
- Preparing reports on potential hazardous waste disposal facilities and submitting them to the State of Tennessee Department of Public Health for seven locations at ORNL.
- Submitting to DOE the Government Accounting Office Site Data Sheets for ORNL.
- Submitting to DOE three additional notifications for inactive CERCLA sites (White Wing Scrap Yard, Low Intensity Test Reactor, and Abandoned Pond 3512).
- Training DEM personnel with four different programs: basic training, RCRA training, advanced training, and new employee training.
- Providing training for other ORNL divisions participating in the disposal of hazardous materials.

4.5 DEM MULTIGROUP FUNCTIONS

4.5.1 Assessment Task Group of the Oak Ridge Task Force

The Oak Ridge Task Force (ORTF) identified the need for a single group to consolidate information and assist in the interpretation of the risk due to environmental contaminants identified on the ORR. At the request of DOE, the Assessment Task Group was formed to provide the ORTF with an integrated assessment of potential health impacts, to develop cost-benefit analyses of alternative remedial measures, to collect and compile data generated during the study from all task groups into a centralized data base, and to provide advice and support to other task groups involved in laboratory or field studies. Staff of the DEM have served on the Assessment Task Group for the past year and a half, have participated in ORTF meetings, and have made presentations to the ORTF.

4.5.2 Quality Assurance

During 1984, the DEM participated in both radiological and nonradiological special quality assurance programs. As part of the NPDES permit, DEM and ORNL's Analytical Chemistry Division participated in the national NPDES Quality Assurance Program. Known standards were submitted to ORNL for analysis of parameters on the current permit. Additional parameters for which standards were received, but which were not on the permit, were also analyzed. The bias about the mean measured by ORNL ranged from −9.3% to 7.3% for the permit parameters. The means for permit and nonpermit parameters were all within EPA's acceptance range. During 1984, DEM also participated in the Seventh International Environmental Dosimeter Intercomparison Project. DEM results for the pre-irradiated field and laboratory dosimeters fell within the confidence intervals for the delivered exposures for this project.

A number of audits and reviews involving the DEM were performed during 1984 to verify that applicable elements of the environmental program have been developed, documented, and effectively implemented in accordance with specific requirements.

4.5.3 Assessment of Contamination of the Oak Ridge Sewage Sludge Land-Farming Site

In 1978 negotiations were initiated between the City of Oak Ridge and DOE-ORO to consider the land disposal of treated sludge from a new city treatment plant, which was scheduled for completion in 1983. The sludge was to be placed on several parcels of land (~610 ha) located within the ORR for a trial period of five years. The sludge was to be used as a nitrogen and phosphorus nutrient supplement for tree planting operations on poor quality forest sites within the reservation. The initial sludge disposal site consisted of 26 ha located on the southeast side of Chestnut Ridge, bordered on the south by the old Bethel Valley Road and on the west by Mount Vernon Road. Deposition on this site began in November 1983.

On March 22, 1984, it was learned that some of the deposited sludge is contaminated with various radionuclides, primarily ^{60}Co and ^{137}Cs. Disposal of sludge on the 26-ha site was temporarily halted on March 25, 1984, and a comprehensive sampling and monitoring study was initiated on March 30, 1984.[2]

[2]T. W. Oakes, H. M. Braunstein, K. L. Daniels, W. F. Ohnesorge, J. T. Kitchings, and W. A. Alexander, *Report on the Oak Ridge Sewage Sludge Land-Farming Experience: Part I—Data Presentation*, ORNL-6062/P1, Oak Ridge Natl. Lab., 1984.

A systematic random sampling design was used to characterize the entire disposal site. Eleven transects were run perpendicular to the surface flow gradient. Soil cores were collected on March 31 and April 1, 1984, along each transect; 117 cores were extracted to various depths, depending on the ability to penetrate the soil layer. The upper 7.6 cm of the core was considered most likely to represent the previously broadcast sludge; the middle portion, the tilled soil mixed with sludge; and the bottom portion, the undisturbed subsurface layer.

Samples were analyzed for gamma activity, principally from ^{137}Cs and ^{60}Co, in all top and middle layer samples. Alpha and beta activity analyses were performed on a random sampling of the extracted cores consisting of 25% of the top portions of the cores (30 samples). Samples were analyzed for ^{90}Sr, ^{234}U, ^{235}U, ^{238}U, ^{238}Pu, and ^{239}Pu.

The majority of the radioactivity was determined to be in the upper 7.6 cm of soil. A total of 170 mCi of activity was estimated as present in the top 7.6 cm layer of the 26-ha site, 69% of which was contributed by ^{60}Co and ^{137}Cs, 23% by ^{234}U and ^{90}Sr, and 8% by other radionuclides.

After the data assessment, calculations were made to delineate the potential dose that might be received from exposure to the contaminated area via five different environmental pathways: (1) direct radiation from the field; (2) inhalation of dust emissions from the sludge disposal area; (3) ingestion of water resulting from radionuclides being leached from the soil and transported via surface runoff into Melton Hill Lake; (4) ingestion of fish caught in Melton Hill Lake; and (5) ingestion of meat from deer that might graze on the contaminated site.[3]

Results of analyses from these pathways are shown in Table 4.3. The annual dose was calculated to be 42 μSv (4.2 mrem) to the endosteal cells (critical organ). The effective dose

Table 4.3. Oak Ridge sewage sludge disposal site: summary of dose contributions by pathway[a] to the maximally exposed member of the public

Pathway	Endosteal cells [μSv/year (mrem/year)]	Effective dose equivalent[b] [μSv (mrem)]
Direct radiation	c	c
Direct inhalation	2.0E−2 (2.0E−3)	5.5E−3 (5.5E−4)
Water ingestion	0.28 (2.8E−2)	3.7E−2 (3.7E−3)
Fish ingestion	41 (4.1)	11 (1.1)
Deer meat ingestion	8.7E−2 (8.7E−3)	2.1 E−2 (2.1E−3)
Total	42 (4.2)	11 (1.1)

[a]All dose commitments have background subtracted.
[b]70-year committed effective dose equivalent.
[c]Measured values were the same as background levels on the old Bethel Valley Road.

[3]T. W. Oakes, W. F. Ohnesorge, K. L. Daniels, H. M. Braunstein, J. T. Kitchings, and W. A. Alexander, *Report on the Oak Ridge Sewage Sludge Land-Farming Experience: Part II—Pathway Analysis, ORNL-6062/P2, Oak Ridge Natl. Lab., 1984.*

equivalent was 11 μSv (1.1 mrem) for a 70-year commitment. Most of the effective dose commitment was due to fish consumption, with a secondary contribution due to the consumption of water through swimming. The nuclides contributing the most to the dose were ^{90}Sr and ^{137}Cs.